Issues in infrastructure and environmental planning

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Gerard Linden, Paul Ike and Henk Voogd

1 Introduction

Planning is both a rational as well as a creative and communicative discipline. It is essentially about shaping the future and managing urban and rural change in a way that benefits current and future generations. It can, for example, make a significant contribution to the achievement of rational goals such as sustainable development or equitable distribution of resources.

The British Royal Town Planning Institute defines spatial planning as a process of critical thinking about space and place as the basis for action and intervention (RTPI, 2003, p.21). This definition suggests that planning is an intellectual process. According to the RTPI, planning is more than a fusion of ‘science and art’, and more than just rule-based processes: ‘It must be informal as well as formal, qualitative as well as quantitative, focused on the achieving of outcomes not just procedures’ (RTPI, 2003, p.21). Apart from being an intellectual process, spatial planning is also a social, political and organisational process. It plays a central role in issues such as urban and rural regeneration, resolving transport problems, designing better towns and cities and protecting and enhancing the environment. It is essentially a process for assisting the community in making decisions about land use and related social and economic activities for the conservation, sustainable development and management of land and its resources.

Environmental and infrastructure planning (EIP) is a specialist area of spatial planning. It focuses on the built fabric of public spaces, institutions, facilities and services that together constitute 'infrastructure', that shape and sustain daily life in an environmentally friendly way. The purpose of EIP is to improve the living environment through integrated environmental management and the delivery of appropriate infrastructure technologies. This is done by research and dissemination of best practices. Consequently, EIP focuses on the natural and physical environment and on the material infrastructure within this environment that supports human activity. This infrastructure can be seen as a product of interacting physical and spatial systems. One of the purposes of EIP is to develop operational strategies that integrate the broadest possible range of policies, methods and actions for improving human settlements, and to resolve in environmental terms the larger social and political issues that affect the quality of life in our communities.

2 The Environmental Layer Concept

The object of environmental and infrastructure planning will be illustrated by means of the layer approach, which was introduced in the Fifth Policy Document on Spatial Planning (VROM, 2001). We have modified this approach slightly and refer to it as the *Environmental Layer Concept* (ELC) (see Figure 1).

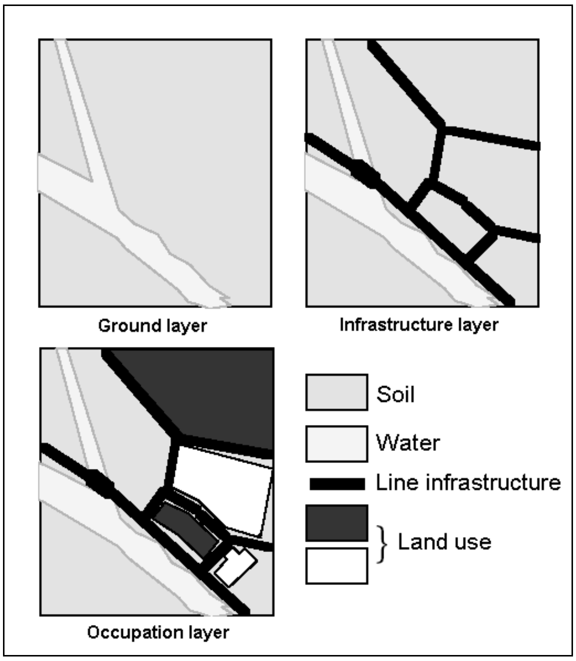


Figure 1. *Illustration of Environmental Layer Concept*

The ELC is a conceptual representation of a spatial-environmental system consisting of three different layers. The first layer is the *ground layer*, in which the natural conditions of the (sub)soil are fixed. For the Netherlands, water systems, altitude, soil types and geological characteristics are important determinants in this layer. The next layer is the *infrastructure layer*, which is composed of various networks that constitute the material infrastructure. This layer consists of visible and invisible elements such as roads, railways, waterways, aviation routes, harbours, airports, transfer points, pipelines and digital networks. The third and final layer of the ELC is the *occupancy layer*, which comprises the physical pattern resulting from the way in which mankind uses the ground layer and networks. In other words, it is the physical reflection of human activities such as housing, working and recreation.

In reality, an ELC is dynamic. Its layers are subject to change. Each layer changes at a different pace and with a different impact. The changes are the result of natural processes and human actions. The dynamics are within and among the different layers. Natural and/or human factors can drive these processes.

2.1 The Ground Layer

Soil types in the *ground layer* have influenced occupancy patterns for centuries. In the past, they determined the type of agriculture, and plant and animal life. Even today, they can influence decision-making.

The geological characteristics of the subsoil are also important for mining activities, such as:

- The *extraction of minerals* (i.e. sand, gravel, clay) for the building industry. As illustrated by Ike (1998, 1999); Ike & Woltjer (1996), Van der Moolen et al., (1998), mineral planning can be very complicated because many conflicting interests are involved and the surface mining of specific minerals, such as gravel and industrial sand, is concentrated in a limited geographical area.
- *Coal mining* was very important in the past in the Dutch province of Limburg. The exploitation of these carboniferous coal beds up to a depth of 900 m was stopped in 1974 due to declining economic feasibility.
- The *production of natural gas* and modest amounts of oil takes place in the north of the Netherlands. The discovery of natural gas played an important role in the decision to close the unprofitable coalmines of Limburg.

- *Salt mining* takes place in the east and north-east of the Netherlands.

The ground layer is important not only for mining but also, more recently, for deep subsurface usage (cf. NIAG-TNO, 2003):

- *Storage of natural gas* in old oil and gas fields. The current storage techniques foresee the storage under supercritical conditions requiring storage facilities to be sited below a depth of 800 m. The storage of natural gas is an interesting option for facilitating peak shaving, allowing capacity to be adapted to the seasonal demand for gas, and offering the possibility to benefit from cheap imports. Advantages of subsurface storage in comparison to storage at the surface are that it is safer and often cheaper, less surface area is used, and it contributes to landscape conservation. The Netherlands currently has subsurface gas-storage facilities in Alkmaar (peak shaving), and in Grijpskerk and Langelo (seasonal fluctuations).
- *Disposal of highly toxic chemical and radioactive wastes* in solid form. This waste requires optimum insulation and must be stored in such a way that can be retrieved at a later date if a more acceptable means of storage or reuse is developed. A storage solution must enable retrieval of the waste at a future date and must be realised at a depth of 500 - 1000 m below the land surface, so that it cannot be affected by glaciation.

Water is another component of the ground layer that plays an important role in EIP because it influences the infrastructure and occupancy layers. Water may also cause harm in the event of flooding. In river basins, flooding is usually the result of heavy rainfall or snow melting in a relatively short period, both leading to the discharge of substantial volumes of river water. In coastal regions, flooding is caused by heavy storms and high tides. In both cases, the history of any country shows that technical measures have been taken to decrease the risk of flooding: the construction of dikes, dams, movable barriers, houses on stakes and boats, can be seen throughout the world. The availability of water for drinking, farming, production and navigation is a precondition for spatial development. At the same time, human activities in the occupancy layer of the ELC can affect water resources in many ways (e.g. see Heathcote, 1998): falling groundwater levels due to over-exploitation, water pollution from industrial, communal and various other sources such as farming, changes in flow direction and speed due to the construction of infrastructure and built-up areas. All these factors can affect the resources used by humans and ecosystems. Without a clear integrated planning system, spatial development can be unattractive and, arguably, unsustainable (Heathcote, 1998, 56). Although urban sewer systems override natural drainage patterns, it is always wise to assess the natural situation of the ground layer at the beginning of a development project. In order to protect water resources, the impact of spatial development must be assessed (see also Chapter 5). In most countries, water management is assigned to one or more public authorities that are responsible for protecting water resources, flood defences, drinking water supply, and wastewater collection and treatment.

2.2 The Infrastructure Layer

In the *infrastructure layer*, EIP focuses on policy coherence with regard to traffic and transport systems. Freight transport has long been one of the Netherlands' main activities, thanks to its key position in the European distribution network. Road transport has been by far the most important mode of freight transportation. Pipelines are also very important, from sewer systems to pipes for the transport of oil, gas, chemicals or other industrial products. In addition, there are many subterranean cables carrying electricity and, more recently, communication channels.

Figure 2.
ICT includes urban infrastructure

This increases the probability of a disaster and is seen as a challenge to improve the planning of underground infrastructure. There is a high safety risk that, for example, a dragline damages one of the many pipes transporting gas and oil, especially in urban areas. Accidents may have serious consequences, including:

- *Economic damage:* production processes halted, breakdown of coolers, and missed orders
- *Environmental damage:* because oil or chemicals may seep into the soil and purification and sewage-treatment plants may fail to work
- *Social damage:* all manner of public and private organisations, as well as individuals, may be seriously hampered in their activities.

Obviously, repairing the damage may be time-consuming and costly if its precise location is not known.

Country	***1970***	***1980***	***1990***	***2000***	***1970=100***
Belgium	488	1,203	1,631	1,702	349
Denmark	184	516	601	922	501
Germany	6,061	9,225	10,809	11,712	193
Greece	11	91	190	707	642
Spain	387	2,008	4,693	9,049	234
France	1,553	4,862	6,824	9,766	629
Ireland	0	0	26	103	∞
Italy	3,913	5,900	6,193	6,478	165
Luxemburg	7	44	78	115	1642
Netherlands	1,209	1,780	2,092	2,289	189
Austria	478	938	1,445	1,633	341
Portugal	66	132	316	1,482	2245
Finland	108	204	225	549	508
Sweden	403	850	939	1,506	374
United Kingdom	1,183	2,683	3,180	39,242	3317
EU total	16,051	30,454	39,242	51,559	321

Source: Eurostat

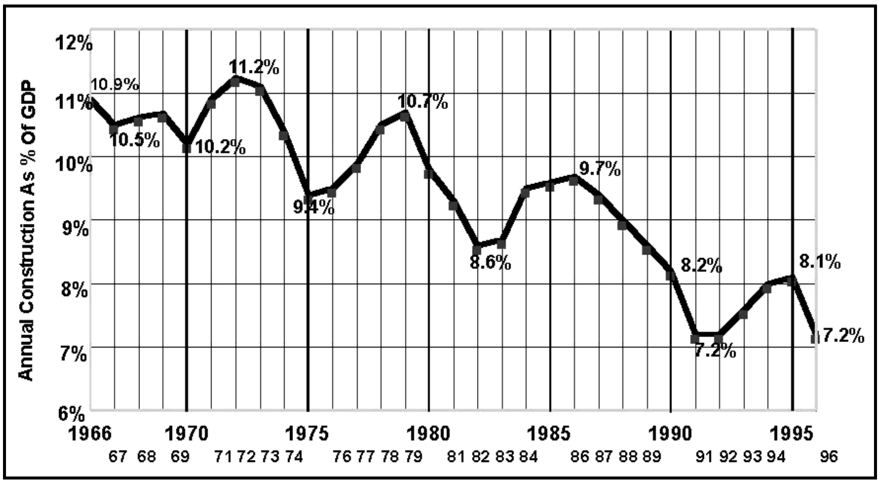
Table 1. *Increase in the length of motorways in the European Union between 1970 and 2000*

Clearly, a transport system is also based on surface infrastructure such as railways, roads, parking facilities, etc. This type of infrastructure has expanded considerably in recent decades (see also Chapter 13). By way of illustration, Table 1 shows the length of motorways, measured in kilometres, over a number of years. It shows that the length of motorways in Europe increased by 321% between 1970 and 2000.

Car ownership has risen dramatically since the 1970s. Measures to reduce road congestion are being considered and partially implemented to guarantee access to commercial centres. For example, in the Netherlands, access to the Randstad conurbation (Amsterdam, The Hague, Rotterdam) is being improved by building new infrastructure at bottleneck locations. Efforts are also being made to reduce car use by encouraging car-sharing, cycling, walking, telecommuting and, in particular, by promoting public transport. For short distances, the bicycle is still the most popular means of transport. In many areas, particularly urban areas, special bicycle paths have been planned and implemented.

2.3 The Occupancy Layer

In recent decades, massive changes have taken place in the size and nature of human settlements (see e.g. Champion and Hugo, 2003). Urban developments clearly provide an economic impetus, as illustrated in Figure 3. This interesting graph shows that annual construction in the United States is strongly influenced by fluctuations in the Gross Domestic Product (GDP). As a consequence of these construction activities, separate cities and towns have merged into extensive conurbations. The planning models for these developments is also known as *growth management* (Stein, 1993). The key elements of growth management are summarised as *the nine C's*: comprehensive planning, consistency, co-ordination, co-operation, collaboration, containment, conversion, concurrency and carrots (see APA, 2002). These are the keywords used in any modern land-use planning document.



Source: US Dept. of Commerce

Figure 3. *Annual construction as percentage of GDP in the USA*

Developing countries and industrialised countries share certain problems in the occupancy layer, but also differ widely. Problems such as inadequate drinking water and sanitation, bad housing conditions, lack of refuse collection and the presence of disease factors are often referred to as the 'brown agenda'. They are essentially problems of developing countries caused by human activity that has a direct impact on human health. The 'grey agenda' refers mainly to the overburdening of the local ecosystem due to the emission of gases, the pollution of water resources, inadequate waste management, etc. These problems occur mostly at the urban level all over the world. Finally, there is a 'green agenda', which mainly addresses nature conservation and ecological properties. It relates to the preservation of bio-diversity, but also includes abiotic issues such as global warming, ozone layer depletion, depletion of natural resources, etc.

In the Netherlands, there is growing emphasis on the concept of the 'ecological city' (e.g. Bus and Voogd, 1998). A considerable number of neighbourhoods have been developed in recent years based on the *Ecopolis* framework of Tjallingii (1995). This comprises three complementary focuses on the city: the responsible city, the living city and the participating city.

The *responsible city* relates to the responsible management of flows into and out of the city. The main problem addressed here is the fact that problems are deflected onto future generations and other places. Modern industrial society has brought not only greater flows of people and information, but also greater flows of energy, materials, traffic and water. Disequilibrium in incoming and outgoing urban flows leads to problems elsewhere: acidification, eutrophication, desiccation, erosion, global warming, etc. Future generations will be exposed to unacceptable risks, and plants and animals are becoming extinct or are at risk of becoming so. The flows into and out of a city (or a neighbourhood or building) can be simplified into an *Ecodevice* model (cf. Girardet, 1992), a box with incoming and outgoing flows. It is important to reduce linear flows into and out of the city, and work towards closed cycles or a circular urban metabolism. In this context, 'sustainability criteria' can be formulated: on the 'IN' side, the priority is to avoid unnecessary use (of energy, materials, etc.). If this is not possible, renewable resources such as biomass, solar energy, etc., should be considered. If it is not possible to avoid the use of non-renewable resources such as minerals and fossil fuels, the priority is to prevent wastage and use them as efficiently as possible. On the 'OUT' side, the priority is also to avoid wastage: it is better not to buy or use a product or material unless it is essential. If this is unavoidable, we should at least try to keep the product or material within the production cycle, so that it is not 'lost' to the environment, where it might cause damage. Finally, if we cannot avoid all forms of waste, we should at least process them using clean technologies so that they do not damage the environment or human health.

The second focus of the Ecopolis model, the *living city*, relates to the sustainable management of urban areas and the creation of a healthy living environment. A problem in this context is the levelling of building sites, which has caused a lot of damage to local ecosystems in the past, and continues to do so. Making optimum use of local ecological potential is an important factor in solving these problems. A city, a neighbourhood or building should not be simply 'pasted' into the environment, but carefully integrated. In developing countries and many countries of Central and Eastern Europe, where living conditions are still far below the levels in industrialized countries, key issues include drinking water, wastewater evacuation, collection of solid waste, public transport, healthy housing, green areas, etc.

The third focus is the *participating city*, whereby the various urban actors play an active role in urban management. Only then will it be possible to make full use of the enormous local resource potential (human and financial). A participating city should stimulate all actors to fulfil their specific responsibilities in the process of city management. Therefore it will also be necessary to raise their awareness of environmental and sustainability issues. In the next section we will discuss this important focal point.

Changes in urban and rural areas, and policies on housing, working and recreation are dependent on changes in the infrastructure layer. New roads, bus lanes, carpool lots, bicycle paths and roundabouts may affect activities in the *occupancy layer*. This is a mutual dependency because new infrastructure may both hamper and stimulate developments; for example, line infrastructure can also be a barrier. Subsurface building is increasingly advocated and applied as a solution.

Figure 4. *Aqueduct over the A4 highway*

In a period of less than ten years, much attention has been devoted to improving underground spatial technology, in particular the tunnel-boring process: tunnel construction, the built-up area and the effects of mitigating measures, including freezing and grouting. The second Heinenoord Tunnel in Rotterdam is the first large-diameter bored road tunnel in the Netherlands. The risks relating to this new construction method – which had never been used on Dutch soil before – proved to be manageable. The tunnel was completed in 1999. The construction of this tunnel proved so successful that the Dutch government decided to bore a tunnel under the Westerschelde waterway, even before the second Heinenoord Tunnel was finished.

The success of the second Heinenoord Tunnel has also contributed to the Dutch government's decision to construct the Green Heart tunnel, which is designed to preserve the landscape between large urban regions in the west of the Netherlands. However, many people do not understand the reasoning behind an expensive tunnel for the High-Speed Train that runs 'under a few meadows'. The Dutch prime minister took a radical decision to break the deadlock in the discussions about the most desirable route for the rail link ('not to the left of the Green Heart, or to the right of it, but underneath it!'). It worked: all actors involved reacted with surprise, but, since the high costs of the project were to be met by the national government, no-one objected.

3 Actors in EIP

Environmental and Infrastructure Planning is essentially concerned with the integration of policy development and implementation. It therefore involves strategic decision-making in the context of political, administrative and legislative frameworks, and implementation by statutory processes and other means. Planning is done by and for people. This implies that many actors are involved. By 'actor' we mean a person, group or organisation with common interests and/or objectives. Sometimes, the EU is considered as a single actor, but the agencies of the European Union have different roles to play and can also be seen as individual actors.

According to Teisman (1992, 55), actors may take different positions in the planning process: interaction, incentive and intervention positions. Actors who try to realize their own targets by co-operating with other actors who have powers take the *interaction position*. An example is co-operation between project developers and landowners. Actors who are not directly involved in the process, but who try to influence other participating actors by providing indirect incentives, usually take the *incentive position*. An example is a higher public authority that stimulates certain policies by providing subsidies. Actors who have the means and power to change a course of action take the *intervention position*. An example is the investor whose money is needed to realise a project ('*implementation power'*) or, on the other hand, the owner of real estate who does not wish to sell his property and therefore blocks new development (*'hindrance power'*).

Planning processes will be managed on the basis of explicit statutory or implicit informal rules on who can do what, when, and on which conditions. This suggests that the planning process is subject to various types of rules. The classifications below are borrowed from Elinor Ostrom (Ostrom, 1986; Ostrom, 1990; Ostrom, Schroeder and Wynne, 1993):

- *Authority rules*: i.e. who has the authority to put forward proposals, what is the planning process about and at which government level is the planning decision to be approved?
- *Information rules*: i.e. the degree to which citizens are offered free access to the information that is necessary to make decisions, as well as the degree to which they are assisted in obtaining that information and on determining which information is crucial to the decision.
- *Boundary rules*: i.e. who can participate? These range from rules that totally exclude or prohibit participation of ordinary people, to rules that allow anyone to participate.
- *Aggregation rules:* these prescribe the mechanism that is to be used to determine whether a valid decision has been reached.

Information about the formal aspects of these rules is usually given in national planning laws and local planning ordinances.

In many countries in Europe, the following principal planning actors can be distinguished: see Tables 2 and 3. This classification is not exhaustive and is intended as an illustration.

Public Actors	***Principal planning task***
European Union	*Strategic Planning* *Operational Planning (i.e. funding)* *Environmental and Economic Legislation*
State Government	*Strategic Planning* *Statutory Planning* *Operational Planning (i.e. funding)* *Environmental Impact Assessment*
Regional Government	*Strategic Planning* *Development Assessment & Control* *Operational Planning (infrastructure, water management)*
Local Government	*Strategic Planning* *Operational Planning (housing, urban renewal, etc.)* *Building and Development Permits*
Water Boards	*Water Management* *Defending water interests*

Table 2. *Overview of principal public-sector actors in the EIP process*

Obviously, the actors mentioned in the tables are not involved in every planning process. The European Union, for example, is especially important when European funding is required for a project. EU policy statements on innovation, social exclusion, equal opportunities, rural development, urban environmental policy and unemployment all influence the context for national policymaking in its member countries. EU structural and cohesion funds have had a major influence on economic and social policy. 'Brussels' increasingly prescribes technical standards that have to be met by EU member states, for example with respect to pollution control, external safety, EIA, etc.

State governments are responsible for incorporating EU rules into the statutory planning framework of the country concerned. The implementation of EU rules varies from country to country. In the Netherlands, for example, the EU Environmental Impact Statement (EIS) directives are co-ordinated by a national EIS review agency, whereas in many other countries there is no formal EIS review procedure (see also Chapter 12). In many, but not all, EU countries, the national government is also responsible for long-term, strategic planning and – more importantly – for funding or co-funding projects and programmes. This funding is usually based on an operational plan that is approved by Parliament on an annual basis.

The regional level is also dealt with differently in Europe (see e.g. Albrechts, 1989; Wannop, 1995; Balchin et al. 1999). In the United Kingdom, there was no tradition of regional planning. Only in recent years have we witnessed a revival. In the Netherlands, however, the provincial authorities have always played a distinct intermediary role in planning. Here, regional plans are prepared for land use and environmental issues, water management, traffic and transportation (see e.g. De Roo, 2004). Provincial authorities can also make plans for other areas if necessary, for example tourism and recreation or mineral extraction (see Ike and Woltjer, 1996; Moolen et al., 1998). In addition, the provinces play a role in assessing and controlling development, for example by reviewing municipal plans for approval.

Local government is an important planning institution because the municipal authorities regulate building and development permits. In most countries, applications for permits must be approved to check if they comply with local land-use plans. Sometimes, additional regulations have to be met, especially with regard to the environment.

With regard to water management, water boards should be mentioned as responsible organisations. In most countries, water management is assigned to one or more public authorities that are

responsible for protecting water resources, for flood defences, drinking water supply, and wastewater collection and treatment. The responsibilities of these authorities are usually restricted to one or more of these aspects. Therefore, Europe has a variety of water boards with different objectives and legal powers.
In addition to the public-sector actors mentioned above, EIP is also strongly influenced by private-sector institutions and even by individual actors. Table 3 gives a summary of the groups most likely to participate as actors in the planning process.

Private Actors	***Principal task***
Research organisations	*Provide arguments and empirical evidence*
Consultancy and engineering Firms	*Provide arguments and technical information*
Development companies	*Create building initiatives*
Building companies	*Create infrastructure*
Investment companies	*Finance infrastructure*
Other stakeholders	*Explain and defend specific interests* *Consuming impacts of EIP*

Table 3. *Overview of principal private-sector actors in the EIP process*

Co-operation between public and private-sector actors, especially with regard to sharing costs, profits and risks in infrastructure planning, has received much attention in recent decades. This type of co-operation is known as *a public-private partnership (PPP)* (see e.g. Brookes et al., 1984; Fosler and Berger, 1982; Weintraub and Kumar, 1997).

A major advantage of a PPP is the increased probability of successful implementation. This is also a major weakness since the focus is usually on a single project, thereby neglecting its impact on developments elsewhere, because the private actors in the partnership do not usually have a special interest in 'elsewhere'. On the other hand, governments should be responsible for their entire jurisdiction, which means that public planners should always aim for an integrated or comprehensive approach.

4 Comprehensive planning

Environmental and Infrastructure Planning is essentially a process for assisting the community, both public and private, in making decisions about infrastructure development, land use and related social and economic activities for the conservation and sustainable development and management of land and its resources. The goal of EIP is to gain a coherent understanding of the interrelationships between the components of the spatial system in order to develop the potential of integrally planned and designed infrastructure systems for dealing more effectively with the critical problems confronting our regions and cities.

The traditional individual treatment of different infrastructure components by means of separate professional disciplines has restricted the development of integrated strategies for building more liveable and efficient urban environments. However, in reality many actors naturally take up 'interaction positions' in the discourse arena in order to pursue their interests – or represented interests. For example, in government too, we notice that various ministries and departments feel a special responsibility for the specific issues they manage, and institutional stakeholders often try to use these official channels to promote their specific wishes and demands. Tourist organisations have a special interest in tourism and recreation planning, sand and gravel companies insist on safeguarding future production spaces through mineral-extraction planning, transport organisations campaign for special anti-congestion policies, etc. In other words, there is a natural tendency towards fragmented, partial, approaches, which is even strengthened by the fact that humans tend to simplify complex situations and hence ignore their broader consequences.

Policy analysts have always been very critical of planners who want to resist this natural tendency by aiming at integrated, comprehensive, planning. Traditionally, the aim of planning is to arrive at well-considered proposals for future actions. Because of the natural tendency of human beings, and therefore also of politicians, to oversimplify complex situations into debatable caricatures of reality, there is need for a scientific, i.e. logically consistent, approach that takes account of complexity and interrelationships. According to Chapin & Kaiser (1985, 63), a 'comprehensive plan' generally includes at least (1) a statement of general goals and the specific objectives of the several functional elements composing the plan and (2) a statement of development and redevelopment proposals for the ensuing twenty to twenty-five years.

Within the rational-comprehensive tradition, there is an ideal-typical planning model that has a number of identifiable stages (see e.g. Friedmann, 1978). A well known example of rational 'process architecture' is:

1. Formulation of goals and objectives.

2. Identification and design of major alternatives for reaching the goals identified within the given decision-making situation.
3. Prediction of major sets of consequences that would be expected to follow upon adoption of each alternative.
4. Evaluation of consequences in relation to desired objectives and other important values.
5. Public consultation.
6. Decision based on information provided in the preceding steps.
7. Implementation of this decision through appropriate institutions.
8. Feedback of actual programme results and their assessment in light of the new planning situation.

This *rational-comprehensive* planning model has been severely criticised in the past, mainly because its neat structure does not correspond with what we witness in practice (for a dated, but not outdated, discussion, see Faludi, 1974, chapter 8). The most famous critic of the rational comprehensive model is the political scientist Lindblom (1959, 1965) who asserted that this model hardly corresponds to planning practice. Lindblom coined the phrase ‘muddling through’ to characterise day-to-day policymaking. He asserts that, rather than attempting a comprehensive survey and evaluation of all the alternatives, in practice decision-makers focus only on those policies that differ substantially from existing policies. Lindblom calls this the *disjointed incrementalist* model. This model considers only a relatively small number of policy alternatives. For each policy alternative, only a restricted number of consequences that are judged to be relevant are evaluated. An important characteristic of the model is that the problem is continually redefined. ‘Incrementalism’ allows for countless end-means and means-ends adjustments, which, in effect, make the problem more manageable. Thus, there is no single ‘right’ decision or solution, but a ‘never-ending series of attacks’ on the issues at hand by means of serial analyses and evaluation. As such, incremental decision-making is described as remedial and geared more towards the alleviation of current actual social imperfections than towards the promotion of future goals.

A third theoretical model that has received much attention is the *mixed scanning* approach of Etzioni (1967). This is essentially a compromise between the rational-comprehensive approach and the disjointed incrementalism approach. According to Etzioni, a thorough consideration of strategic developments is essential as a guideline for incremental day-to-day decision-making. We notice that the ‘two-step’ mixed scanning model is very similar to public planning in practice. Municipal authorities, for example, often have a long-term strategic plan and several operational plans or project plans. However, most public decisions are routine. Incremental decision making deals with selective issues as they arise. These issues may require slightly new thinking, but they are not significant enough to trigger a ‘policy window’ (i.e. sudden widespread attention for a policy issue) or fundamental decisions. Thus they are dealt with ad hoc and in a disjointed manner, using whatever analysis is close at hand, without any comprehensive review of all the associated issues. Policy processes that operate through disjointed incrementalism pose both challenges and opportunities for researchers. On the one hand, policymakers in this decision-making mode are looking for analyses that can provide quick support to decisions that are already half-made, and they may be less inclined to consider evidence that would be time-consuming to understand and adapt. On the other hand, the ad hoc nature of decision-making also implies that any new evidence which fits in and is helpful on a case-by-case basis, and which is presented at just the right moment, has a good chance of being picked up and used almost immediately.

After Etzioni, planning theory naturally continued to develop primarily in the direction of dealing with the multiplicity of interests involved in planning. Evidently, planners and governments need the support of citizens for their proposed decisions, otherwise a proposed planning improvement will never be realised, at least not within an effective democratic political structure. The concept of *participatory planning* therefore received increasing attention in the 1960s and 1970s, alongside strong social movements for peace and environmental protection, with citizens demanding more influence over government decision-making (Godschalk and Mills, 1966; Fagence, 1977; see also Chapter 3). Through participation, the citizen learns ‘that he has to take into account wider matters than his own immediate private interests if he is to gain co-operation from others, and he learns that the public and private interest are linked’ (Pateman, 1970, 25).

A community may hold strong views on the desirability of a particular land use, to be denoted as:

- **Lulu** : Locally unwanted land use
- **Nimby** : Not in my backyard
- **Niaby** : Not in anybody’s backyard
- **Pitby** : Put it in their backyard
- **Biybytim:** Better in your backyard than in mine
- **Yimby** : Yes in my backyard .

Many people have questioned the notion of a single common interest in society, and the ability of a political elite, whether elected in a representative democracy or otherwise appointed in any form of aristocracy, to protect that collective interest. Sandercock (1998), for example, refers to the post-modern disintegration of the notion that planners can work towards a single universal collective interest. Rather, a ‘multiplicity’ or ‘plurality’ of interests in society has become evident, meaning that a range of voices must be heard if all interests are to be protected.

The phasing of the rational-comprehensive model assumes that public and political involvement is *reactive*, i.e. experts provide information and the public, including politicians, can respond. By contrast, modern planning philosophies assume the *proactive* involvement of interest groups, i.e. plans and programmes are developed in close consultation with stakeholders (e.g. see Dryzek, 1970; Forester, 1989, 1999; Healey, 1997; Woltjer, 2000; Klijn and Koppenjan, 2002). As with rational-comprehensive planning, the collaborative comprehensive approach is also based on unrealistic assumptions, for example the assumption that there is always a feasible consensus (‘win-win’) solution implies that the existence of a conflict is denied. According to Voogd and Woltjer (1999), planning discourse cannot be effective if it is not based on planning intelligence. This involves gathering, organising, analysing, and disseminating information to and from stakeholders involved in the use and development of land.

5 Planning Intelligence

According to Schurz (1989), the adult brain can cope with some 10^6 different items. A person’s average vocabulary is 10^5 words, of which 10^4 are actually used. This is also the maximum number of complex systems our memory can deal with. So if n! is the set of n interrelated elements of a system, then the representation limit is n=8. Evidently, 8! = 4032 x 10^4. This implies that the average human brain cannot deal properly with systems that are larger than 8 elements. It is obvious that integrated environmental and infrastructure systems often consist of many more than 8 elements. In practice there is a tendency at an early stage radically to simplify complex systems into manageable proportions. Planning skills and planning intelligence in particular are therefore desirable, at least from an intellectual point of view, to support the early stages of planning and programming for arriving at ‘informed decision making’.

The purpose of planning intelligence is to collect and analyse information that can be used in the planning process to assist human decision-making (see also Wyatt, 1989; Kaiser et al., 1995). Planning intelligence supports all forms of planning activity: strategic planning (long-term strategies), problem-solving (short-term projects), and development administration and management. The purpose of the intelligence is to assist in (a) describing the history and current status, (b) forecasting the future status, (c) monitoring, recording, and interpreting changes, (d) diagnosing planning and development problems, (e) assessing the supply/demand balance, (f) modelling relationships, impacts, and contingencies, and (g) presenting information to planners, stakeholders and the general public. An example of an approach based on planning intelligence is *impact assessment* (e.g. Arts, 1994, 1998; Niekerk, 2000; Niekerk and Voogd, 1999).

A computer-assisted approach to problem-solving and decision-making has always been important for planners, according to Mandelbaum (1996), although its reception has varied over the years. A history of the use of information technology in planning can be found in Batty (1995) and Brail & Klosterman (2001). The early 1960s were the heyday of the rational planning paradigm and the corresponding enthusiasm for the use of computerised technology and modelling techniques in particular. The 1970s brought widespread criticism of computerised tools and modelling, due to their limited ability to provide solutions that could be easily translated into daily planning practice and urban development issues. In the 1980s, information technology democratised in step with the planning process itself, which was an important step towards the broad acceptance of the personal computer as a planning tool. The 1990s brought new tools to address new planning challenges, particularly in terms of spatial marketing (Ashworth and Voogd, 1995) and planning support systems (Linden, 1989, 1996; Harris, 1989). The past decade has seen the increased use of computer spreadsheets, geographic information systems (GIS) and web-based technologies (see e.g. Batty, 1995; Klosterman, 1999; Geertman and Stillwell, 2002; Pettit et al., 2002). The future appears to be in web-based planning intelligence.

The New Map of the Netherlands is an interesting example of web-based planning intelligence. This is a database containing all the spatial plans of the municipal and provincial authorities, and national government departments.

Residential	All manner of residential developments fall within the residential land-use category. A distinction is made between ‘greenfield’ residential development and urban restructuring.
Commercial, Industrial, Agricultural	This land-use group encompasses all commercial, industrial, agricultural and other business developments. As with residential development, a distinction is made between ‘greenfield’ development and the revitalization of business areas.
Nature and recreation	Nature and recreation constitute a single land-use category because it is often hard to distinguish between pure ‘natural’ development and recreational development.
Infrastructure	This land-use category encompasses all transport-related development (e.g. roads, railways, canals and airports).
Water	As ideas about water management in the Netherlands change, water boards are making a claim on land. Areas zoned for emergency water containment are included.
Urban restructuring	This category includes all the areas designated by the 30 largest municipalities for urban restructuring.

Table 4. *Categories of land use included in the New Map*

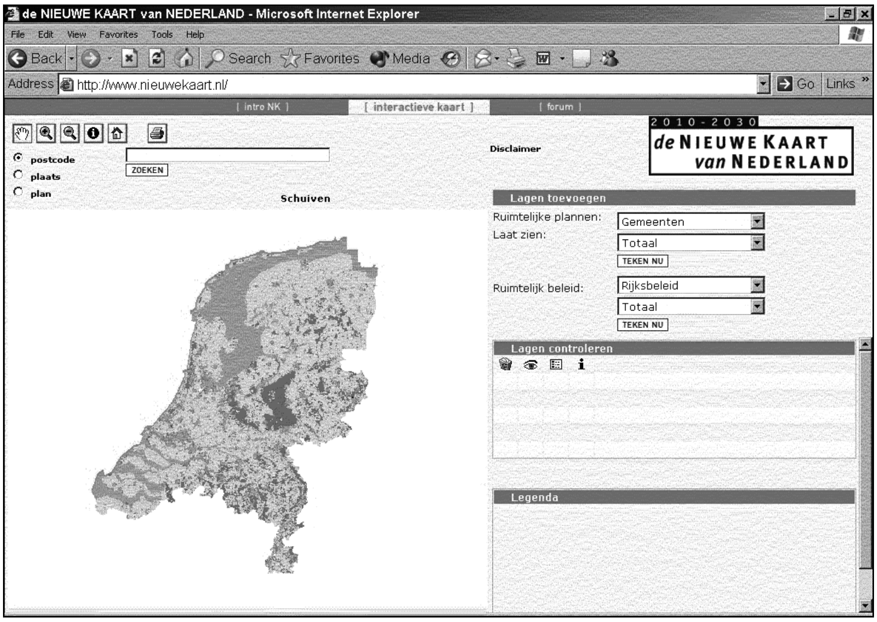


Figure 4. *The opening page of the New Map website*

The GIS database on which the New Map is based is available in the following formats: ArcView, MapInfo and NEN1878. It can also be accessed on the Internet at *www.nieuwekaart.nl*. This website provides an overview of all urban and rural developments (e.g. residential, business and infrastructure) planned in the Netherlands for the coming decades. Plans for urban restructuring, new recreational resorts and new nature reserves are also included. Municipal and provincial authorities, national government departments, water boards and design agencies have submitted their projects to the New Map of the Netherlands. Figure 4 shows the opening page.

On the left-hand side of Figure 4, the user can select the region about which information is required, for example by entering the name of a municipality or postcode. The desired region can be selected by zooming in or out. On the right-hand side, the type of plan and level of government can be selected. For example, the city of Groningen (see Figure 5).

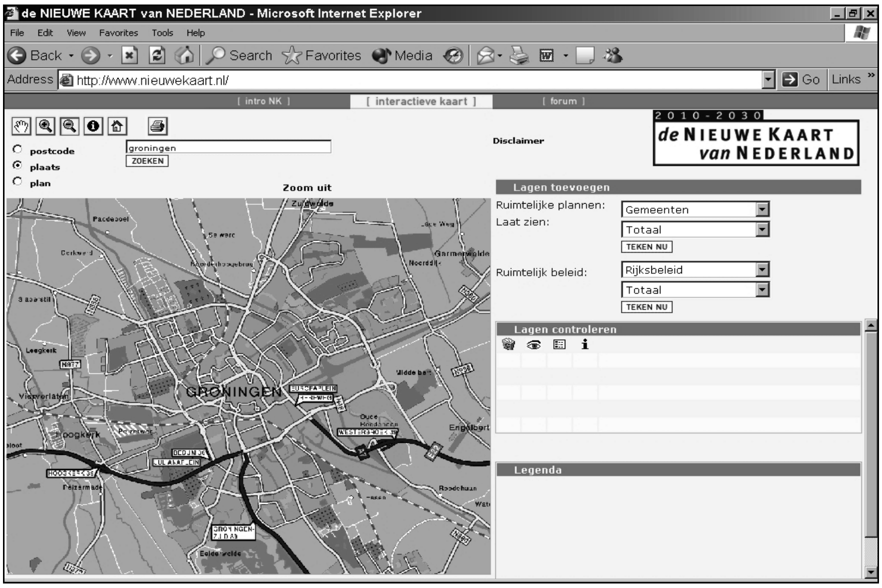


Figure 5. *The city of Groningen*

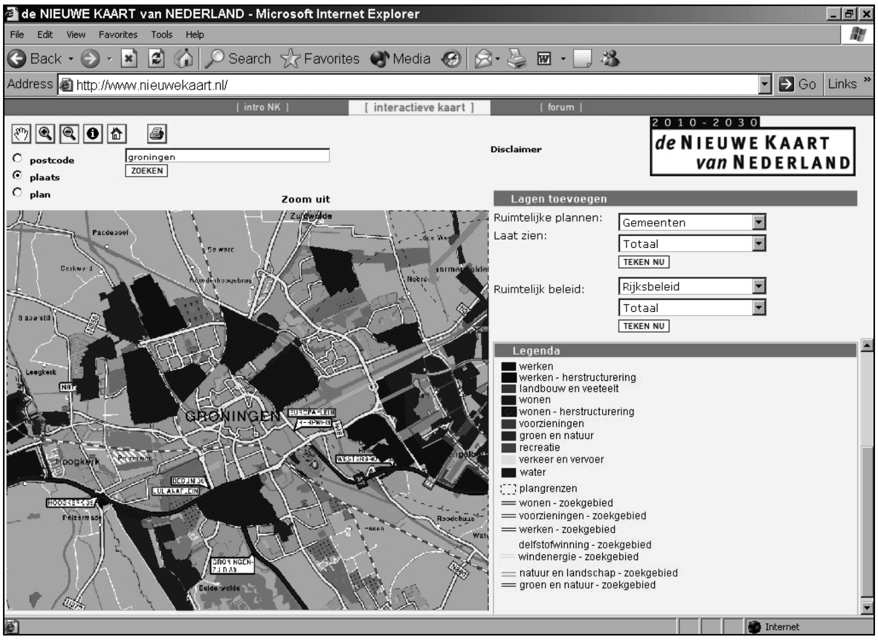


Figure 6. *Overview of all spatial plans in Groningen*

6 Some conclusions

Due to its complexity, environmental and infrastructure planning can never be reduced to a simple technical exercise based only on planning intelligence. Planning processes will always be social and political processes, too. It is the task of planners to help organise these processes, i.e. to design a structure for discourse and decision-making and provide relevant information.

Today, visualisation is seen as a major interface between planning intelligence and its users. GIS technology, and mapping facilities in particular, is increasingly important for communicating different outcomes. Of course, we must be aware that visual representations can be misleading (see e.g. Monmonier, 1991). However, this is not only true of visualisations – every day, politicians and commercials show us how words and other means of communication can be manipulated.

References

Albrechts, L. [ed.] (1989), *Regional Policy at the Crossroads: European Perspectives*, Jessica Kingsley Publishers, London.

APA (2002), *Policy Guide on Smart Growth*, American Planning Association, Chicago.

Arts, E.J.M.M. (1994), Environmental Impact Assessment: from Ex Ante to Ex Post Evaluation, in H. Voogd (ed), *Issues in Environmental Planning*, Pion Ltd, London, 145-163

Arts, E.J.M.M. (1998), *EIA-Follow-Up – On the role of Ex Post Evaluation in Environmental Impact Assessment*, GeoPress, Groningen.

Ashworth, G.J., H. Voogd (1995), *Selling the City*, Wiley, Chichester/New York

Balchin, P., L. Sýkora, G. Bull (1999), *Regional Policy and Planning in Europe*, Routledge, London.

Batty, M. (1995), Planning Support Systems and the new logic of computation, *Regional Development Dialogue*, 16 (1) 1-17

Brail, R.K., R.E. Klosterman (eds) (2001), *Planning Support Systems: Integrating Geographic Information Systems, Models, and Visualization Tools*, ESRI Press, Redland CA.

Bus, A.G., H. Voogd (1998), From Household to Urban Metabolism: Ecological Renewal of Neighbourhoods, in K.J. Noorman, T. Schoot Uiterkamp (eds), *Green Households? Domestic Consumers, Environment and Sustainability*, Earthscan, London, 121-140.

Campbell, S., S. S. Fainstein (eds.) (1996), *Readings in Planning Theory*, Blackwell, Oxford.

Chapin F.S. Jr. and E.J. Kaiser (1985), *Urban Land Use Planning*, University of Illinois Press, Urbana and Chicago (third edition).

Champion, T., G. Hugo (eds) (2004), *New Forms of Urbanization – Beyond the Urban-Rural Dichotomy*, Ashgate, Aldershot.

De Roo, G. (2003), *Environmental Planning in the Netherlands: too good to be true*, Ashgate, Aldershot.

Dryzek, J. S. (1990), *Discursive Democracy: Politics, Policy, and Political Science*, Cambridge University Press, Cambridge.

Etzioni, A. (1967), Mixed scanning: a ‘third’ approach to decision-making, *Public*

Administration Review, Vol. 27, 385-392.
Fagence, M. (1977), *Citizen Participation in Planning*, Pergamon Press, Oxford.
Faludi, A. (1973), *Planning Theory*, Pergamon Press, Oxford.
Flyvbjerg, B. (2001), *Making Social Science Matter: Why Social Inquiry Fails and How it Can Succeed Again*, Cambridge University Press, Cambridge
Forester, J. (1989), *Planning in the Face of Power*, University of California Press, Berkeley.
Forester, J. (1999), *The Deliberative Practitioner: Encouraging Participatory Planning Processes*, MIT Press, Cambridge MA.
Friedmann, J. (1987), *Planning in the Public Domain: From Knowledge to Action*, Princeton University Press, Princeton NJ.
Friedmann, J. (1998), 'The New Political Economy of Planning: The Rise of Civil Society', in M. Douglass and J. Friedmann (eds.) (1998), *Cities for Citizens: Planning and the Rise of Civil Society in the Global Age*, Wiley, Chichester/New York, 19-35.
Geertman, S. and J. Stillwell (eds) (2003), *Planning Support Systems in Practice*, Springer, Berlin,
Girardet, H. (1992), *The Gaia Atlas of Cities, new directions for sustainable urban living*. Gaia Books. London.
Godschalk, D. R. and W. E. Mills (1966), 'A Collaborative Approach to Planning through Urban Activities', *Journal of the American Institute of Planners*, 32, 2, 86-94.
Harris, B. (1989), Beyond Geographic Information Systems: computers and the planning professional, *Journal of the American Planning Association*, 55, 85-90.
Healey, P. (1997), *Collaborative Planning: Shaping Places in Fragmented Societies*, MacMillan Press, London.
Heathcote, I.W. (1998), *Integrated Watershed Management: Principles and Practice*, Wiley, London/New York.
Ike, P. and J. Woltjer (1996), New Dutch mineral planning in a structural outline plan: from zoning to import, *Mineral Planning*, 66, March, 7-10.
Ike, P. (1998), Wood, not concrete? The spatial impact of mineral quarrying versus afforestation, *Mineral Planning*, 74, March, 9-13
Ike, P. (1999), Inter-provincial divisions in the Netherlands, in Fuchs, P.E.K., M.R. Smith and M.J. Arthur (eds), *Mineral Planning in Europe*, The Institute of Quarrying, p. 85-98
Kaiser, E.J., Godschalk, D.R., & Chapin, F.S. Jr. (1995). *Urban Land Use Planning*. Urbana and Chicago, IL: University of Illinois Press (fourth edition).
Klijn, E.H. and J. F. M. Koppenjan (2002), 'Rediscovering the Citizen: New Roles for Politicians in Interactive Policy Making', in P. McLaverty (ed.), *Public Participation and Innovations in Community Governance*, Ashgate, Aldershot, 141-164.
Klosterman, R.E. (1999), New tools for spatial analysis and planning as components of an incremental planning-support system, *Environment & Planning B*, 26, 365-380.
Lindblom, C.E. (1959) The science of muddling through, *Public Administration Review*, 19, 79-88.
Lindblom, C.E. (1965) *The Intelligence of Democracy*, Free Press, New York.
Linden, G.J.J. (1989), *Highway Location; towards a framework for planning support*, Geo Press, Groningen

Linden G.J.J. (1996), *Research Methodology for Multi-Media Development*, HKU-KMT, Utrecht /Hilversum
Mandelbaum, S.J. (1996). Making and Braking Planning Tools. *Computers, Environment and Urban Systems* 20(2): 71-84.
Monmonier, M. (1991), *How to Lie with Maps*, The University of Chicago Press, Chicago.
Moolen, B. van der, A. Richardson, H. Voogd (eds) (1998), *Mineral Planning in a European Context*, Geo Press, Groningen
NIAG-TNO (2003), Multiple Use of Deep Subsurface Space, Netherlands Institute of Applied Geoscience, Utrecht, May, report 2003/7.44E.
Newman, P, A. Thornley (1996), *Urban Planning in Europe*, Routledge, London.
Niekerk, F. (2000), Het effect gerapporteerd [Reporting about impacts], Geo Pers, Groningen.
Niekerk, F. and H. Voogd (1999), Impact Assessment for Infrastructure Planning: some Dutch dilemmas, *Environmental Impact Assessment Review*, 19, 21-36
Pateman, C. (1970), *Participation and Democratic Theory*, Cambridge University Press, Cambridge.
Pettit, C., T.K. Shyy and R. Stimson (2002), On line planning support systems to evaluate urban and regional planning scenarios, in S. Geertman and J. Stillwell (eds), *Planning Support Systems in Practice*, Springer, Berlin, 331-348.
Sandercock, L. (1998), *Towards Cosmopolis: Planning for Multicultural Cities*, Wiley, Chichester/New York.
SRKI (2003), *Balansboek Rood-Groen*, Stichting Recreatie, Kennis en Innovatiecentrum, The Hague.
Stein, J.M. (1993), *Growth Management, the Planning Challenge of the 1990's*, Sage, London/New Delhi.
Teisman, G.R. (1992), Complexe Besluitvorming. Een pluricentrisch perspectief op besluitvorming over ruimtelijke investeringen, VUGA, Den Haag
Tjallingii, S.P. (1995), *Ecopolis, Strategies for ecologically sound urban development.* Backhuys Publishers, Leiden
Van der Moolen, B, A. Richardson, H. Voogd (eds) (1998), *Mineral Planning in a European Context*, Geo Press, Groningen
Voogd, H. and J. Woltjer (1999), The communicative ideology in spatial planning: some critical reflections based on Dutch experiences, *Environment & Planning B*, vol. 26(6), 835 – 854.
Voerknecht, H. (1994), Experiences with Environmental Zoning: The Case of the Drechtsteden Region, in H. Voogd (ed), *Issues in Environmental Planning*, Pion Ltd., London, 67-77.
VROM (2001), Ruimte maken, ruimte delen, Ministry of Housing, Physical Planning and Environment, The Hague.
Wannop, U.A. (1995), *The Regional Imperative, Regional Planning and Governance in Britain, Europe and the United States*, Jessica Kingsley, London.
Wates, N. (2000), *The Community Planning Handbook: How people can shape their cities, towns and villages in any part of the world*, Earthscan, London.
Weintraub, J., K. Kumar (eds), *Public and Private in Thought and Practice*, University of Chicago Press, Chicago Illinois.
Woltjer, J. (2000), *Consensus planning, the relevance of communicative planning theory in Dutch infrastructure development.* Ashgate, Aldershot.
Wyatt, R. (1989), *Intelligent Planning*, Unwin Hyman, London.